Abstract Submitted to the
International Conference on Strongly Correlated Electron Systems
University of Michigan, Ann Arbor
August 6-10, 2001

Topological excitations and the phase diagram of the superconducting cuprates

Eduardo C. Marino, Marcello B. Silva Neto
Instituto de Fisica, Universidade Federal do Rio de Janeiro
Caixa Postal 68528, 21945-970, Rio de Janeiro - RJ, Brazil

We study the destruction of the long-range antiferromagnetic order in the high-T_c cuprate superconductors $La_{2-x}Sr_xCuO_4$ and $YBa_2Cu_3O_{6+x}$. The CP^1-nonlinear sigma model formulation of the two-dimensional quantum Heisenberg antiferromagnet is used for describing the pure system. Dopants are introduced as independent fermions with an appropriate dispersion relation determined by the shape of the Fermi surface. Skyrmion topological defects are shown to be introduced by doping and their energy is used as an order parameter for the antiferromagnetic state. We obtain analytic expressions for the skyrmion energy as a function of doping which allow us to plot, without adjustable parameters, the curves $T_N(x_c) \times x_c$ and $M(x) \times x$, for the two compounds, in good quantitative agreement with the available experimental data. A picture emerges then that stripes formation would presumably occur in LSCO (but not in YBCO) leading to a slower decrease of the magnetization curves with doping in comparison to the case where they are absent. Finally, we briefly discuss the predictions of our model for the phase diagram of BiSCCO.